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SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-AB-2001-014**
Graham, R.P. and Iverson, M.P. (Thiokol), "Modern SRM Ignition Transient Modeling, Part 4: Development of the Structural/Ballistic Analysis System (SBAS-II)"

AIAA Joint Propulsion Conference **(Statement A)**
(Salt Lake City, UT, 8-11 July 2001) (Deadline: Past Due)

Abstract for 37th Joint Propulsion Conference (Salt Lake City, 7/2001)
(SRM Chairman: Alan Loveless (Thiokol) 435-863-5412)

Modern SRM Ignition Transient Modeling
Part 4: Development of the Structural/Ballistic Analysis System SBAS-II

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Development continues on a system of computer codes for modeling propellant grains during ignition and burning, including the possibility of flaw initiation and growth. This system is known as the Structural/Ballistic Analysis System, or SBAS. It comprises a collection of separate computer codes which each address a different aspect of motor operation, including structural deformation, propellant burn-back, internal ballistics, gas flow, fracture propagation, and crack combustion. At the heart of the SBAS is an executive module that interfaces with each of the individual analysis codes, transfers data from one to another, maintains a central model database, and includes model generation and examination functions.

The original SBAS development took place between 1988 and 1995 under a USAF funded technology program. The emphasis of this program was to evaluate the operation of motors with known defects. The concept of the SBAS proved to be useful, although the original SBAS had some limitations. Improvements are now taking place in a new USAF funded program. This updated version is called SBAS-II.

During the original development, small motors were static tested to evaluate the predictive capabilities of the SBAS. These motors were designed to produce crack and debond propagation during firing. Motor operation was monitored with real-time radiography, pressure transducers, strain gages, and displacement transducers. The SBAS was reasonably successful at predicting the initiation of fracture propagation in these motors, but generally over-predicted the rates of propagation. In analyzing the motors, the original SBAS was found to be rather cumbersome, requiring substantial user interaction at every step in the analysis. Modeling the propagation of three-dimensional defects was particularly difficult.

Development now in progress will improve accuracy and streamline user interaction. Improved fracture models will be incorporated and automated fracture mesh generation will be added. Two- and three-dimensional fluid dynamics will be added. A programmable scripting language will control the analysis sequence. To verify general usability, engineers at three different companies will test the software.

This paper gives an executive summary of the SBAS development. It provides an overview of the capabilities of the SBAS and describes the improvements planned for SBAS-II, but does not give any significant technical detail.